

63 a clamping device for injection molding the molten metal or the semi-solidified slurry discharged from said nozzle, wherein said clamping device is adapted to open or close a movable plate relative to a stationary plate in a horizontal.

REMARKS

Favorable reconsideration of the present application is respectfully requested.

New Claims 26-30 have been introduced. Claims 2-30 are active in the application.

The feature "nozzle discharge port opening/closing means for opening or closing a discharge port of said nozzle" has been added to the independent apparatus Claim 25. This feature is supported by the description at page 13, lines 14-20 and the description of the solid-plug (page 25, lines 4-10) and the self closing type nozzle (page 25, lines 13-19) in the specification. That is, "nozzle discharge port opening/closing means" covers both kinds of constructions to open and close a discharge port. Therefore, Claims 15 and 16 have been amended so as to depend from Claim 25, in order to further specify the nozzle discharge port opening/closing means.

The amended claims are clearly distinguishable over any combination of JP1-166874 and Wang. The presently recited "nozzle discharge port opening/closing means" enables the present invention to meter the amount of semi-solidified slurry to be injected. As described in page 18, lines 14-15, the nozzle is always closed except for injection step. The nozzle is closed while metering, as described page 16, lines 3-18. Regarding the third embodiment, there described accumulating a predetermined amount of the semi-solidified slurry in the second channel of the metering cylinder in page 19, lines 11-12. The accumulating step advances with the nozzle closed because the nozzle is closed except for injection step. Thus,

since a predetermined amount of the semi-solidified slurry is metered and injected, an amount precisely required for a mold can be injected without wasted semi-solidified slurry.

On the other hand, the discharge end of the horizontal flow path in JP1-166874 is neither narrowed like a nozzle nor provided with an opening/closing means. It is always wide open to clamping device. The construction in JP1-166874 cannot allow flow control of the molten metal or semi-solidified slurry. Therefore, such metering function as realized in the present invention is impossible in JP1-166874. Wang provides no teaching for overcoming this shortcoming of JP1-166874.

The Examiner has evidently alleged that the portion of the lower end of the vertical chamber in JP1-166874 is "nozzle at the end of the connection member" because the portion has a nozzle-like shape. However, as compared with the present invention, it is in the middle (between the first channel and the second channel) of the connection member rather than at the end of the connection member. In order to further clarify the invention in this respect, new Claim 31 recites a "nozzle connected at the discharge end of said second internal channel."

Wang discloses a nozzle and a valve pin with a spring to close the nozzle. However, the nozzle discharge port opening/closing means of the present invention connected at the discharge end of the horizontal second internal channel is not obvious over the valve pin with the spring provided at the lower end of the vertical chamber. As described in column 7, lines 10-14, of the reference, "a simple but effective design of a spring-loaded shut-off nozzle is used to block the material from flowing out of the nozzle (due to gravity) during barrel loading in the vertical machine." This description indicates that the opening/closing means of Wang et al can be applied only to a vertical flow path. Therefore, the disclosure of Wang cannot suggest the opening/closing means at the discharge end of the horizontal flow path in

the present invention. In any case, Wang discloses an apparatus wherein the material moves only vertically and whose height is very large, while in the present invention it is not necessary to locate the screw extruder at a higher position even when the molding is enlarged or the stroke amount is increased. That is, the present invention is provided for avoiding a structure like Wang.

New Claim 28 is provided in order to cover the third embodiment without unnecessary limitations. Therefore, the feature "an injection plunger provided in the second internal channel, said injection plunger moving in the horizontal direction for injecting the molten metal or semi-solidified slurry" is included in addition to nozzle discharge port opening/closing means. However, "the extrusion screw is mounted for movement in the axial direction thereof, to extrude the molten metal of the semi-solidified slurry" is omitted. Claim 28 is also different from JP1-166874 because of the inclusion of nozzle discharge port opening/closing means, and is unobvious over JP1-166874 because of the metering function realized by the means.

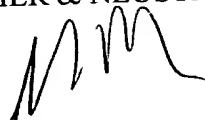
The independent method Claim 24 has been amended so as to include the feature that a predetermined amount of semi-solidified slurry is injected. As explained above, the metering function is the most important distinction of the present invention over JP1-166874. New dependent method claims 26 and 27 are provided which further limit the injection method.

The tertiary references to Kono, Rock and Mercer were cited to teach details of the dependent claims and cannot provide teachings for overcoming the aforementioned shortcomings of JP1-166874 and Wang.

Applicants believe that the present application is in a condition for allowance and respectfully solicit an early Notice of Allowability.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Norman F. Oblon
Attorney of Record
Registration No. 24,618
Robert T. Pous
Attorney of Record
Registration No. 29,099



22850

(703) 413-3000

GJM:RTP/cja

I:\atty\RTP\00231785-am4.wpd

Marked-Up Copy
Serial No: 09/550,331
Amendment Filed Herewith

IN THE CLAIMS

--15. (Amended) An injection molding apparatus as defined in claim 25, wherein said nozzle discharge port opening/closing means is a temperature setting member disposed in [a] the discharge port of the nozzle for forming a solid plug.

16. (Amended) An injection molding apparatus as defined in claim 25, wherein said nozzle discharge port opening/closing means is an on/off valve disposed [to a portion downstream to the static mixer for opening or closing] in the discharge port of the nozzle.

24. (Amended) A method of injection molding a light metal alloy comprising the steps of:

cooling a molten metal under shearing by an extrusion screw into a semi-solidified slurry in a substantially vertical chamber;

discharging the semi-solidified slurry from a discharge port at the lower end of the chamber [by moving the extrusion screw in the axial direction thereof];

turning the semi-solidified slurry in the horizontal direction;

filling an internal channel of the horizontal direction with the semi-solidified slurry;

and

injecting the turned semi-solidified slurry of a predetermined amount into molding plates opening or dosing in the horizontal direction from the discharge end of the second internal channel of the horizontal direction.

25. (Amended) An injection molding apparatus for a light metal alloy, comprising:

a chamber;

a extrusion screw located substantially vertically and provided rotationally inside said chamber, wherein the extrusion screw is mounted for movement in the axial direction thereof, to extrude the molten metal of the semi-solidified slurry;

a cooling unit for cooling a light metal material supplied in said chamber so as to be formed into a molten metal or semi-solidified slurry;

a connection member having a first internal channel substantially in a vertical direction and a second internal channel extending horizontally from the lower end of the first channel, said connection member being connected to a discharge port of said chamber;

a nozzle connected at the discharge end of said connection member;

nozzle discharge port opening/closing means for opening or closing a discharge port of said nozzle; and

a clamping device for injection molding the molten metal or the semi-solidified slurry discharged from said nozzle, wherein said clamping device is adapted to open or close a movable plate relative to a stationary plate in a horizontal.

26-31. (New).--